CLAIMS

What is claimed is:

1. A method for forming a feature in a layer, comprising:

forming a photoresist layer over the layer;

patterning the photoresist layer to form photoresist features with photoresist sidewalls, where the photoresist features have a first critical dimension;

depositing a conformal layer over the sidewalls of the photoresist features to reduce the critical dimensions of the photoresist features; and

etching features into the layer, wherein the layer features have a second critical dimension, which is less than the first critical dimension.

2. The method, as recited in claim 1, wherein the depositing the conformal layer over the sidewalls of the photoresist features, comprises:

a first deposition with a first gas chemistry to form a first deposition plasma; and

a second deposition with a second gas chemistry to form a second deposition plasma, wherein the first gas chemistry is different than the second gas chemistry.

3. The method, as recited in claim 2, wherein the depositing the conformal layer over the photoresist features further comprises:

a third deposition with the first gas chemistry to form a third deposition plasma; and

a fourth deposition with the second gas chemistry to form a fourth deposition plasma.

4. The method, as recited in claim 3, wherein the second critical dimension is not greater than 70% of the first critical dimension.

5. The method, as recited in claim 4, wherein the depositing the conformal layer over the sidewalls forms substantially vertical sidewalls.

6. The method, as recited in claim 5, wherein the photoresist layer is formed from 248 nm photoresist and the feature has a CD not greater than 140 nm.

7. The method, as recited in claim 5, further comprising stripping the photoresist mask and deposited conformal layer with a single stripping step.

8. The method, as recited in claim 7, wherein the stripping the photoresist mask and deposited conformal layer comprises ashing the photoresist mask and deposited layer.

9. The method, as recited in claim 4, wherein the conformal layer has a sidewall thickness, wherein the conformal layer has substantially the same sidewall thickness from a top to a bottom of the feature.

10. The method, as recited in claim 4, wherein the conformal layer has a sidewall thickness and a photoresist feature bottom thickness, wherein the sidewall thickness is greater than the photoresist feature bottom thickness.

11. The method, as recited in claim 1, wherein the second critical dimension is not greater than 70% of the first critical dimension.

12. The method, as recited in claim 1, wherein the photoresist layer is formed from 248 nm photoresist and the feature has a CD not greater than 140 nm.

13. A semiconductor device formed by the method of claim 1.

14. A method for forming a feature in a layer, comprising:

forming a photoresist layer over the layer;

patterning the photoresist layer to form photoresist features with photoresist sidewalls, where the photoresist features have a first critical dimension;

depositing a layer over the sidewalls of the photoresist features to reduce the critical dimensions of the photoresist features, wherein the depositing the layer over the sidewalls of the photoresist feature, comprises:

a first deposition with a first gas chemistry to form a first deposition plasma; and

a second deposition with a second gas chemistry to form a second deposition plasma, wherein the first gas chemistry is different than the second gas

chemistry; and

etching features into the layer, wherein the layer features have a second critical dimension, wherein the second critical dimension is not greater than 70% of the first critical dimension.

15. The method, as recited in claim 14, wherein the second critical dimension is not greater than 60% of the first critical dimension.

16. The method, as recited in claim 14, wherein the depositing the layer over the photoresist features further comprises:

a third deposition with the first gas chemistry to form a third deposition plasma; and

a fourth deposition with the second gas chemistry to form a fourth deposition plasma.

17. The method, as recited in claim 16, wherein the depositing the layer over the sidewalls forms substantially vertical sidewalls.

18. An apparatus for forming a feature in a layer, wherein the layer is supported by a substrate and wherein the layer is covered by a photoresist mask with photoresist features with a first CD, comprising:

a plasma processing chamber, comprising:

a chamber wall forming a plasma processing chamber enclosure;

a substrate support for supporting a substrate within the plasma processing chamber enclosure;

a pressure regulator for regulating the pressure in the plasma processing chamber enclosure;

at least one electrode for providing power to the plasma processing chamber enclosure for sustaining a plasma;

a gas inlet for providing gas into the plasma processing chamber enclosure; and

a gas outlet for exhausting gas from the plasma processing chamber enclosure;

a gas source in fluid connection with the gas inlet, comprising

a first deposition gas source;

a second deposition gas source; and

an etchant gas source;

a controller controllably connected to the gas source and the at least one electrode, comprising:

at least one processor; and

computer readable media, comprising:

computer readable code for providing at least three deposition cycles to form a sidewall deposition on a photoresist mask to form features with a second CD, within the photoresist features, comprising:

computer readable code for providing a flow of a first deposition gas from the first deposition gas source to the plasma processing chamber enclosure;

computer readable code for stopping the flow of the first deposition gas from the first deposition gas source to the plasma processing chamber enclosure;

computer readable code for providing a flow of a second deposition gas from the second deposition gas source to the plasma processing chamber enclosure after the flow of the first deposition gas is stopped; and

computer readable code for stopping the flow of the second deposition gas from the second deposition gas source to the plasma processing chamber enclosure;

computer readable code for providing a flow of an etchant gas from the etchant gas source to the plasma processing chamber after completion of the at least three deposition cycles; and

computer readable code for etching features in the layer, using the etchant gas wherein the features in the layer have a third CD.

19. The apparatus, as recited in claim 18, wherein the second CD is less than 70% of the first CD, and wherein the third CD is less than 70% of the first CD.

20. The apparatus, as recited in claim 18, wherein the sidewall deposition is highly conformal.

21. A method of forming a plurality of conductive lines, comprising:

placing a conductive layer over a substrate;

forming a mask, wherein the mask defines a plurality of mask lines with

mask spaces between the mask lines, wherein the mask spaces have a width and wherein the mask lines have a width and have sidewalls;

depositing a conformal layer over the sidewalls of the mask;

etching the conductive layer through the mask to form conductive lines and spaces between the conductive lines, wherein the conductive lines have a width and the spaces between the conductive line have widths, wherein the widths of the spaces between the conductive lines is less than the widths of the mask spaces, and wherein the widths of the conductive lines is greater than the widths of the line masks.

22. The method, as recited in claim 21, wherein a ratio of the widths of the mask lines to the widths of the mask spaces is less than 1:1 and wherein a ratio of the widths of the conductive lines to the widths of the spaces between the conductive lines is not less than 1:1.

23. The method, as recited in claim 21, wherein a ratio of the widths of the mask lines to the widths of the mask spaces is less than 1:1 and wherein a ratio of the widths of the conductive lines to the widths of the spaces between the conductive lines is greater than 1:1.

24. The method, as recited in claim 21, wherein the widths of the mask spaces is more than 50% greater than the widths of the spaces between the conductive lines.

25. The method, as recited in claim 1, further comprising etching the conformal layer with a first etch recipe, wherein the etching of the conductive

layer uses a second etch recipe, which is different than the first etch chemistry.

26. A semiconductor device formed by the method of claim 21.

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